

MAJOR ISSUES AND FINDINGS

Lead, Zinc, and Other Trace Elements

Parts of the Ozark Plateaus have a history as major producers of lead and zinc. Mining in the Study Unit has occurred primarily in four main lead-zinc mining districts—the Southeastern District (Old Lead Belt, Viburnum Trend, and the Fredericktown subdistricts), the Tri-State District, the Central District, and the North Arkansas District. By far the most important ore deposits were in the Southeastern and Tri-State Districts. The Viburnum Trend subdistrict is the only area still mined for lead or zinc.

Concentrations of sulfate and some trace elements in water from streams in areas of historical or active lead-zinc mining tend to be higher than in areas where mining has not occurred. These trace element concentrations decrease with increasing distance downstream from the mining activity. Concentrations usually did not exceed Federal standards or criteria for the protection of drinking water, human health, or aquatic life.

In water samples collected in 1992-95, dissolved sulfate and several trace elements were detected more commonly and were detected in higher concentrations at sites in areas of his-

torical or ongoing lead-zinc mining than at sites in other areas. Sulfate, barium, copper, manganese, molybdenum, and zinc concentrations were higher in samples from sites downstream from mining areas. Lead concentrations were not higher in mining areas. Concentrations of sulfate and trace elements generally decreased with increasing distance downstream from a mining activity.

At most sites, concentrations usually did not exceed U.S. Environmental Protection Agency drinking-water standards or criteria for protection of human health or aquatic life. However, zinc concentrations often exceeded freshwater aquatic life criteria in Center Creek.

Concentrations of lead and zinc in bed sediment and fish or clam tissue are substantially higher at sites with mining activities (historical or active) in the basin. Concentrations are high enough to suggest potential adverse biological effects. The State of Missouri has issued a fish consumption advisory for some streams.

Lead and zinc concentrations in bed sediment at sites downstream from lead-zinc mines in the Tri-State Dis-

trict, the Old Lead Belt, and the Viburnum Trend may have adverse biological effects on benthic organisms. Long and Morgan (1991) developed guidelines called “effects range thresholds” for use in assessing potential adverse effects on biota. In general, the “effects range-low” threshold can be considered to have adverse effects on some benthic organisms, while the “effects range-median” threshold can be considered frequently or always to have adverse effects on these organisms. In at least one bed-sediment sample from each of the three mining areas, concentrations of lead and zinc were equal to or higher than the effects range-low threshold. Lead and zinc concentrations from sites downstream from the Tri-State District and the Old Lead Belt commonly were substantially higher than the effects-range median threshold.

Concentrations of lead and zinc in bed sediment were highest at sites downstream from historical lead-zinc mining areas. Concentrations of both elements are much higher at sites downstream from the historical mining areas in the Tri-State District and the Old Lead Belt than at sites downstream from mining areas in the Viburnum Trend.

Lead and zinc concentrations in water, bed sediment, and fish or clam tissue from mining and background areas of the Ozark Plateaus

[Background values are minimum and maximum concentrations associated with sites not considered to be influenced by mining in these or other areas. Sites immediately upstream from mining areas are not included in background sites. Tissue concentrations are in fish liver or soft tissue of Asiatic clam. Values in red substantially exceed background concentration data collected 1992-95. µg/L, micrograms per liter; µg/g, micrograms per gram; <, less than; --, not measured or not applicable]

| Site | Mining area | Lead | | | Zinc | | |
|--------------------------|----------------|--------------|---------------------|---------------|--------------|---------------------|---------------|
| | | Water (µg/L) | Bed sediment (µg/g) | Tissue (µg/g) | Water (µg/L) | Bed sediment (µg/g) | Tissue (µg/g) |
| Center Creek | Tri-State | <1 | 370 | 0.3 | 67-270 | 5,600 | 770 |
| Big River | Old Lead Belt | <1 | 2,300 | 134 | 8-19 | 670 | 514 |
| Meramec River | Old Lead Belt | -- | 180 | 12.2 | -- | 140 | 296 |
| West Fork of Black River | Viburnum Trend | <1-11 | 10-95 | 0.5-8.3 | 13-33 | 12-46 | 70-110 |
| Strother Creek | Viburnum Trend | <1-3 | 20 | 0.7 | 33-148 | 120 | 150 |
| Background | -- | <1-20 | 15-28 | <0.1-0.6 | <1-44 | 43-140 | 57-230 |

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Lead concentrations in bed sediment were substantially higher at sites within, or downstream from, the Tri-State District and the Old Lead Belt subdistrict and at one site in the Viburnum Trend subdistrict. In the Viburnum Trend subdistrict, concentrations of lead returned to background levels at sites about 15 miles downstream from mine discharges.

Zinc concentrations in bed sediment were highest at one site downstream from the Tri-State District and one site downstream from the Old Lead Belt. Concentrations at sites just downstream from mines in the Viburnum Trend were higher than concentrations at sites upstream from these mines or farther downstream; however, these concentrations were not higher than the maximum background concentra-

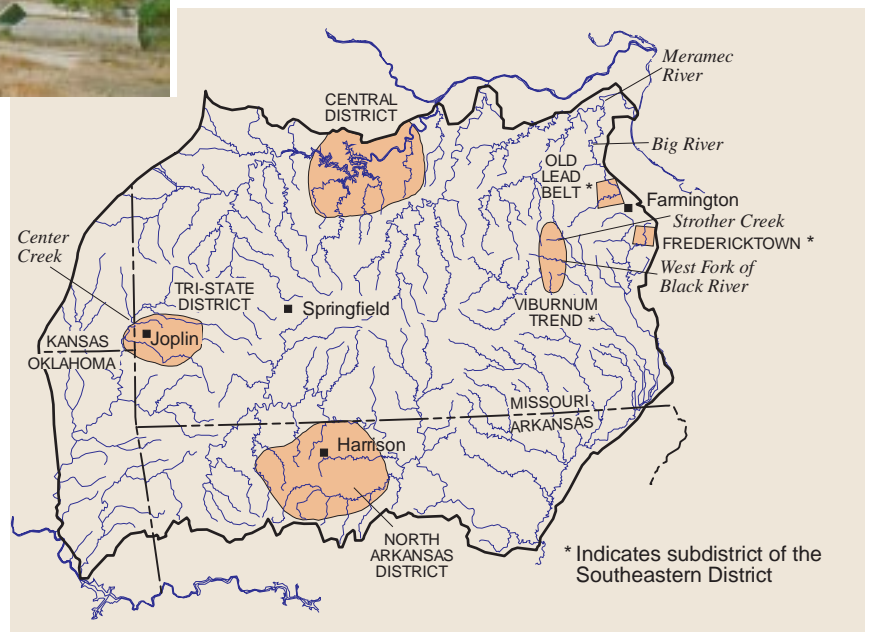
tions at sites throughout the Study Unit. At sites about 15 miles downstream from mines in the Viburnum Trend, bed-sediment concentrations of zinc were similar to concentrations upstream from the mines.

The relation between tissue concentrations at background sites and sites downstream from mining areas is similar to the relation between bed-sediment concentrations at these same sites. Lead concentrations in tissue were somewhat higher than background concentrations at some sites in the Viburnum Trend and substantially higher at sites downstream from the Old Lead Belt. The lead concentration at the site in the Tri-State District was at background levels and substantially lower than at sites downstream from the Old Lead Belt. Zinc concentrations

were not higher than background concentrations at sites in the Viburnum Trend, but were somewhat higher than background concentrations at sites in the Tri-State District and downstream from the Old Lead Belt. The elevated lead and zinc concentrations in tissue and reduced enzyme activity in fish exposed to lead in mining areas of the Ozark Plateaus (Schmitt and others, 1993) suggest that both elements are available to fish and Asiatic clams for biological processing. The State of Missouri currently (1998) advises the public to not eat some species of fish from some rivers affected by past mining in the Old Lead Belt (Gale Carlson, Missouri Department of Health, written commun., 1998).



Lead-zinc mining tailings near Joplin, Mo. Downstream from mining areas, concentrations of lead, zinc, and other elements generally are relatively low in water but are elevated in bed sediment and in fish and clam tissue. In bed sediment, concentrations at some locations may be harmful to aquatic wildlife.



Lead-zinc mining areas of the Ozark Plateaus. The Viburnum Trend subdistrict is the only area currently (1998) being mined for lead or zinc.